Appendix: Nomenclature

Chapter 2: Roman letters

Symbol	Meaning	Unit
A	amplitude of surface wave	m
A_j	(complex) amplitude of tidal component	[various]
a	right ascension	rad or °
a	magnitude of tidal stream in x-direction	$m.s^{-1}$
b	magnitude of tidal stream in y-direction	$m.s^{-1}$
d	declination of tide-raising body	rad or °
e	eccentricity of ellipse	-
h	depth of ocean	m
h	Love number, $h \approx 0.60$	-
G	gravitation constant = $6.670 \cdot 10^{-11}$ $N.m^2.kg^{-2}$	$N.m^2.kg^{-2}$
g	gravitational acceleration = 9.80665 $m.s^{-2}$	$m.s^{-2}$
g_j	phase lag of tidal component	rad or °
H_j	amplitude of tidal component	[various]
k	wave-number in x-direction	$rad.m^{-1}$
l	Love number, $l \approx 0.07$	-
t	time	s
M_B	mass of tide-raising body	kg
M_E	mass of the Earth $\approx 5.97 \cdot 10^{24}$ kg	kg
N	number of harmonic components in a decomposition	-
P	point at which tide is evaluated	-
r	distance from centre of Earth	m
r_B	distance of tide-raising body from centre of Earth	m
r_E	radius of the Earth $\approx 6.4 \cdot 10^6$ m	m
t	time	s
u	velocity in x-direction	$m.s^{-1}$
v	velocity in y-direction	$m.s^{-1}$
W	tidal potential	$m^2.s^{-2}$
W_2	2^{nd} order spherical harmonic, approximating W	$m^2.s^{-2}$
w	velocity in z-direction	$m.s^{-1}$
x	ecliptic longitude of moon	rad or °
x'	ecliptic longitude of sun	rad or °
x	horizontal spatial co-ordinate	m
y	ecliptic latitude	rad or °
y	horizontal spatial co-ordinate	m
Z	terrestrial longitude with respect to lower transit	rad or °
z	vertical spatial co-ordinate	m

Chapter 2: Greek letters

Symbol	Meaning	Unit
ε	strain	-
ζ	arbitrary tidal signal	[various]
ζ_{eq}	vertical displacement of sea-surface (‘equilibrium tide’)	m

ζ_O	vertical displacement of sea-surface ('ocean tide')	m
ζ_S	vertical displacement of Earth's surface ('solid tide')	m
λ	(terrestrial) latitude – angle above equator	rad or °
ν	Poisson's ratio or Earth, $\nu \approx 0.25$	-
ρ_0	average density of seawater ≈ 1025 kg.m^{-3}	kg.m^{-3}
Φ_L	lunar phase parameter	-
Ω	angular frequency	rad.s^{-1}
ω	angular frequency	rad.s^{-1}
ω_j	angular frequency of tidal component	rad.s^{-1}

Chapter 3: Roman letters

Symbol	Meaning	Unit
A	matrix used in Bayesian drift algorithm	-
$A_j(t)$	j'th (complex) harmonic constant (Admiralty Method)	-
$b_j(t)$	j'th basis function (Admiralty Method)	-
$\hat{b}_j(t)$	j'th basis function (Harmonic Method)	-
D	matrix used in Bayesian drift algorithm	-
d_j	drift signal in the time domain	[various]
$d_k(f)$	weights used in derivation of $\hat{S}_{MWPS}(f)$	-
f	frequency	s^{-1}
$F_j(t)$	amplitude of j'th basis function (Admiralty Method)	-
g_j	phase lag of j'th harmonic constant (Admiralty Method)	rad or °
$\hat{g}_j$	phase lag of j'th harmonic constant (Harmonic Method)	rad or °
H_j	magnitude of j'th harmonic constant (Admiralty Method)	[various]
$\hat{H}_j$	magnitude of j'th harmonic constant (Harmonic Method)	[various]
i	$\sqrt{-1}$	-
K	number of eigenspectra used to define $\hat{S}_{MWPS}(f)$	-
$K(f)$	arbitrary kernel function	-
$K_F(f)$	Fejer kernel function	-
$L(v)$	marginal posterior likelihood	-
M	number of data sections used for section-averaging	-
N	number of data points in time-series	-
$\underline{P}$	extended parameter vector	[various]
$S(f)$	true power spectrum	[various]
$\hat{S}_{BA}(f)$	band-averaged estimate of power spectrum	[various]
$\hat{S}_{MWPS}(f)$	multiple window estimate of power spectrum	[various]
$\hat{S}_P(f)$	(unwindowed) periodogram estimate of power spectrum	[various]
$\hat{S}_{SA}(f)$	section-averaged estimate of power spectrum	[various]
$\hat{S}_{WP}(f)$	windowed periodogram estimate of power spectrum	[various]
t	time	s
t_j	time of j'th data point	s
T	matrix of Admiralty Method basis functions	-
W	bandwidth in frequency domain	s^{-1}
$W_S(f)$	spectral window	-
$v_j^{(m)}$	m^{th} discrete prolate spheroidal sequence	-
w_j	data window in the time domain	-
w_m	Huber weights used in robust section-averaging	-

$\underline{X}$	extended data vector	[various]
x_j	data series in the time domain	[various]

Chapter 3: Greek letters

Symbol	Meaning	Unit
Δt	sampling interval	s
$\varepsilon(t)$	error component of time-series	[various]
$\zeta(t)$	time-series to be analysed	[various]
$\underline{\theta}$	vector expressing harmonic constants	[various]
μ	median of several estimates of a harmonic constant	[various]
ν	hyperparameter controlling smoothness of drift signal	[various]
π	3.141592	-
σ	interquartile distance of estimates of a harmonic constant	[various]
σ^2	variance of random variable	[various]
$\sigma_B^{\ 2}$	data variance	[various]
$\varphi_j(t)$	phase of j'th basis function (Admiralty Method)	rad or °
ω_j	angular frequency of j'th tidal component	$rad.s^{-1}$

Chapter 4: Roman letters

Symbol	Meaning	Unit
T	temperature	ºC
t	time	s
Teffk	Medusa effluent temperature (Teffk = Th + Tk)	ºC
Tefft	Medusa effluent temperature (Teffk = Th + Tt)	ºC
Th	Medusa thermistor channel (calibrated)	ºC
Th	Medusa thermistor channel (uncalibrated)	-
Tk	Medusa type-K thermocouple channel (calibrated)	ºC
Tk	Medusa type-K thermocouple channel (uncalibrated)	-
Tt	Medusa type-T thermocouple channel (calibrated)	ºC
Tt	Medusa type-T thermocouple channel (uncalibrated)	-
v	Medusa velocity channel (calibrated)	$mm.s^{-1}$
v	Medusa velocity channel (uncalibrated)	-
ve	eastward velocity measured by current meter	$mm.s^{-1}$
vn	northward velocity measured by current meter	$mm.s^{-1}$
z	depth below seafloor	m

Chapter 4: Greek letters

Symbol	Meaning	Unit
ε_j	attenuation factor	-
κ	thermal diffusivity	$m^2.s^{-1}$
φ_j	phase lag	rad

Chapter 5: Roman letters

Symbol	Meaning	Unit
c_p	specific heat capacity	$J.kg^{-1}.K^{-1}$
d	vertical distance of penetration of thermal signal	m
F	fluxibility	$J.s.m^{-5}$
g	gravitational acceleration = 9.80665 $m.s^{-2}$	$m.s^{-2}$
H	depth of magma chamber below seafloor	m
H_R	thickness of reaction zone	m
h	specific enthalpy	$J.kg^{-1}$
k	permeability	m^2
L	half-width of magma chamber	m
L_D	half-width of discharge zone	m
p	pressure	Pa
Ra_L	local Rayleigh number	-
s	specific entropy	$J.K^{-1}.kg^{-1}$
T	temperature	°C
T_0	temperature of ‘cold’ water in convection cell	°C
t	time	s
t_D	residence time in discharge zone	s
t_R	residence time in reaction zone	s
$\boldsymbol{u}$	(vector) Darcy velocity	$m.s^{-1}$
u	horizontal Darcy velocity	$m.s^{-1}$
w	vertical Darcy velocity	$m.s^{-1}$
x	horizontal spatial coordinate	m
z	vertical spatial coordinate	m

Chapter 5: Greek letters

Symbol	Meaning	Unit
Δp	pressure difference	Pa
ΔT	temperature difference	°C
λ	thermal conductivity	$W.m^{-1}.K^{-1}$
μ	dynamic viscosity of fluid	Pa.s
π	3.141592	-
ρ	fluid density	$kg.m^{-3}$
ρ_0	density of cold water	$kg.m^{-3}$
Φ	order of magnitude of advective heat flux	$W.m^{-2}$

Chapter 6: Roman letters

Symbol	Meaning	Unit
A	complex amplitude of incremental velocity	$m.s^{-1}$
B	complex amplitude of incremental enthalpy	$J.kg^{-1}$
d	skindepth	m
d_{1d}	1-d skindepth	m
d_{2d}	2-d skindepth	m

$\hat{e}_{ij}$	incremental strain tensor of fluid-filled porous medium	-
g	gravitational acceleration = 9.80665 m.s^{-2}	m.s^{-2}
H	depth below seafloor of impermeable layer	m
h	steady specific enthalpy	J.kg^{-1}
h_0	steady specific enthalpy on seafloor	Pa
$\hat{h}$	incremental specific enthalpy	J.kg^{-1}
K_f	fluid bulk modulus	Pa
K_{fh}	isenthalpic fluid bulk modulus	Pa
K_{fT}	isothermal fluid bulk modulus	Pa
K_g	grain bulk modulus	Pa
K_m	matrix bulk modulus	Pa
k	permeability	m^2
L	half-width of magma chamber	m
M_T	tidal flow magnitude parameter	m$^{5/2}$.s$^{-1/2}$.kg$^{-1/2}$
p	steady pore pressure	Pa
p_0	steady pressure on seafloor	Pa
$\hat{p}$	incremental pore pressure	Pa
$\hat{p}_c$	incremental confining pressure	Pa
p_T	magnitude of tidal pressure oscillation on seafloor	Pa
Q	heat sink	W.m^{-3}
S	storage compressibility	Pa^{-1}
T	steady temperature	°C
t	time	s
w	steady vertical velocity	m.s^{-1}
$\hat{w}$	incremental vertical velocity	m.s^{-1}
x	horizontal spatial coordinate	m
x_i	(1st rank tensor) spatial coordinate	m
z	vertical spatial coordinate	m

Chapter 6: Greek letters

Symbol	Meaning	Unit
α	coefficient of effective stress	-
β	Skempton ratio	-
Γ	vertical enthalpy gradient	J.kg^{-1}.m^{-1}
γ_{1d}	1-d loading efficiency	-
γ_{2d}	2-d loading efficiency	-
δ_{ij}	Kronecker delta tensor	-
κ	diffusivity	m^2.s^{-1}
κ_{1d}	1-d diffusivity	m^2.s^{-1}
κ_{2d}	2-d diffusivity	m^2.s^{-1}
μ	dynamic viscosity of fluid	Pa.s
ν	Poisson's ratio	-
π	3.141592	-
ρ	steady fluid density	kg.m^{-3}
$\hat{\rho}$	incremental fluid density	kg.m^{-3}
$\hat{\sigma}_{ij}$	incremental stress tensor of fluid-filled porous medium	Pa
φ_0	porosity	-
φ_c	critical porosity	-

ω	angular frequency	rad.s^{-1}

Chapter 7: Roman letters

Symbol	Meaning	Unit
p	pressure	Pa
T	temperature	°C
X	salinity (wt % NaCl)	-
X_g	salinity of gas phase (wt % NaCl)	-
X_l	salinity of liquid phase (wt % NaCl)	-

Chapter 7: Greek letters

Symbol	Meaning	Unit
ρ_{SW}	seawater resitivity	Ω.m